Space Weather Technical Forecast

Issued on Friday, 11 August 2023 at 13:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low, with occasional C-class flares observed. Peak flare was C8.3 at 11/0645 UTC, however a number of C-flares have been observed from AR3395 in the northwest. This region is the most complex on the disc, with recent flux emergence to its north and west, along with penumbra development resulting in the formation of a couple of weak delta spots. AR3394 in the southwest is dominated by a single large central spot, with a number of smaller peripheral spots around it, however it remains a stable and inactive region. AR3397 in the north-centre has also seen some flux emergence but persists as a small and simple region. There are no Earth-directed CMEs.

Solar Wind / Geomagnetic Activity: Solar winds became slightly elevated, perhaps from a weak high speed stream from an uncertain source. Speeds observed at L1 by DSCOVR and Ace rose from background, below 400km/s to be slightly elevated between 400-500km/s. Density was at or below average values. The total Interplanetary Magnetic Field (IMF), Bt, was mostly at weak levels, but rose after 10/1606 UTC to briefly reach moderate levels, peaking at 10 nT at 10/1649 UTC, before easing to mainly weak from 10/2130 UTC. The north-south component, Bz, was initially weakly negative with minimum of -5nT, but then mainly positive from 10/1600 with maximum 8nT. Phi angle was predominantly negative (towards the Sun). Quiet (Kp 1-2) geomagnetic conditions throughout.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux continued erratically easing, after the enhancement due to the 07 Aug X1.5 flare from Ex-AR3386 (now long-past the western limb). Having peaked at 47pfu early on 09 August, flux remained below the S1 level through the last 24 hours, but above background, with peak 8.19pfu at 10/1225 UTC. High energy (greater than 2MeV) electron flux at GOES16 was background to moderate levels but increased above the High threshold between 10/1430-1745 UTC, peaking at 1710 pfu at 10/1700 UTC. The associated 24-hour integrated fluence remained below the Active level (1e8 integrated pfu), with 1.77e7 integrated pfu recorded at 12/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate expected, with a chance of M-flares, with the main risk from developing region AR3395 in the northwest

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs, with the next notable coronal hole enhancement not expected until either late day 4, or more likely beyond this forecast period, on day 5 (14-15 Aug). Geomagnetic activity is forecast to be mainly Quiet with a chance of isolated Unsettled spells.

Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux (GOES-16) is expected to continue declining erratically towards background. There is only a slight chance of further enhancements from any of the active regions currently on the disc, with the greatest risk from AR3395 or AR3394 if either were to produce a notable flare. The high energy (greater than 2 MeV) electron flux (GOES-16) is expected to continue varying between Moderate

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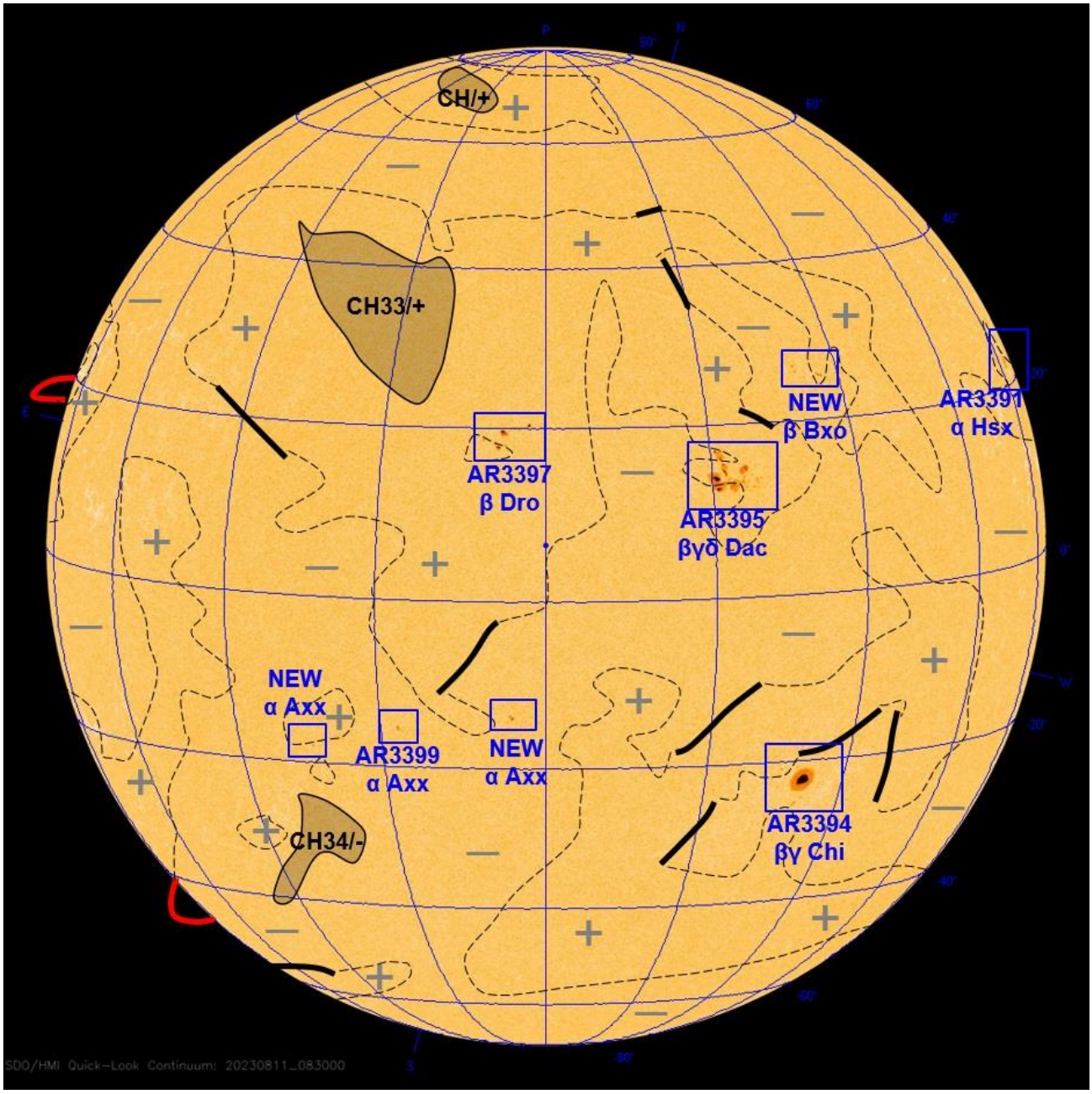
and Background, with brief diurnal peaks of High (above 1000pfu). The associated fluence is expected to remain below the Active threshold (1e8 integrated pfu).

Figure 1. Solar Analysis Valid 11/0800UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

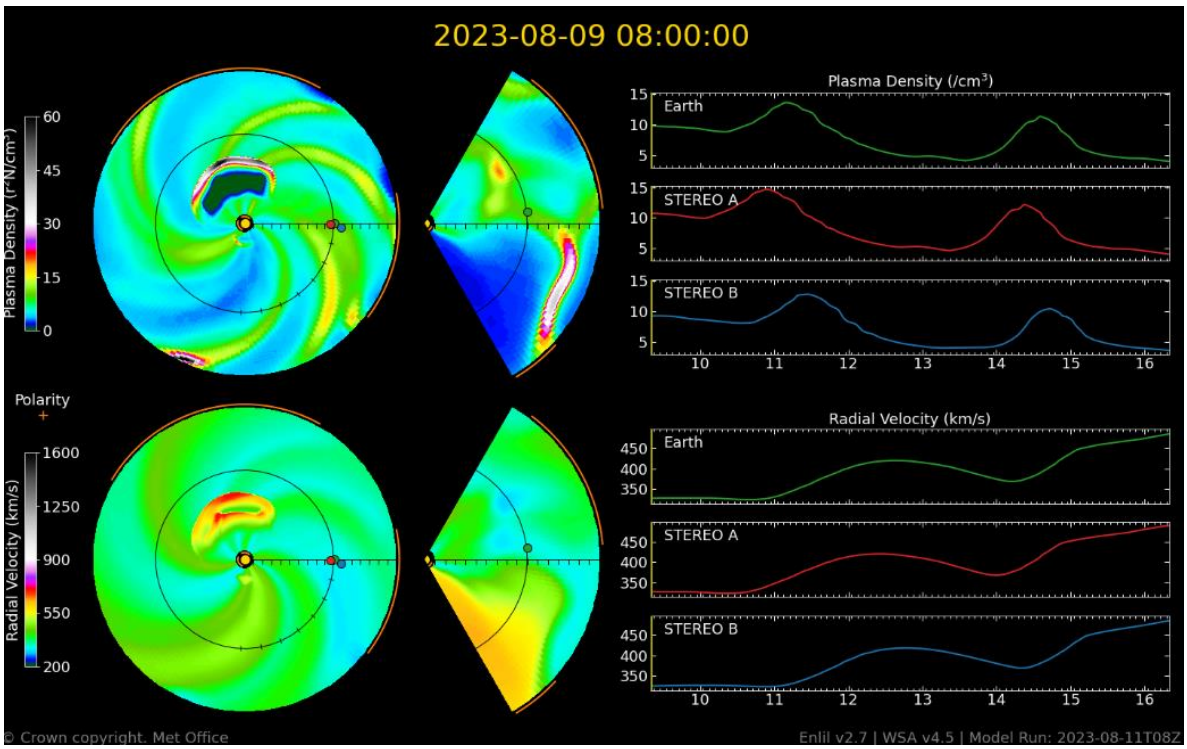
There are no Earth-directed CMEs.

Solar winds are expected to vary between background and slightly elevated levels of 350-450km/s, with no significant coronal holes or other sources of enhancement indicated until at least the end of day 4 (14 Aug) or more likely beyond this forecast period on day 5 (15 Aug) from CH33/+ in the northeast disc. This is supported by Enlil.

Geomagnetic activity is forecast to be mainly Quiet with isolated Unsettled intervals.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Enlil, with no notable enhancements expected at Earth until at least later on 14th, or 15th



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Radio Blackouts - X-Ray Flares:

Solar Activity is currently Low, with eight sunspot regions currently on the disc, and activity is expected to remain Low to Moderate with a chance of M-flares.

The main region of interest is AR3395 in the northwest disc. This is a slowly growing region of moderate size, with a complex parity separation line and a number of delta spots evident. This includes the development of a number of dark umbra cores in the last 24 hours, with flux emergence to its north and west. Further growth is likely through the period, and this will bring an increased chance of M-flares.

There are two other regions of interest, AR3394 in the southwest and AR3397 in the north-centre disc. AR3394 is a stable, but moderately sized region, with some small complexity in its magnetic structure and if it was to reactivate would have the potential for M-flares. AR3397 is a small region that has seen recent emergence and growth, and will need monitoring for any further development. A recent C-flare has also been observed over the northeast limb, however it is currently too soon to determine the source of this activity.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	55	55	50	50
Very Active	R3 to R5 X Class	No	2	2	2	2

Figure 3a: GOES-16/18 X-ray Flux

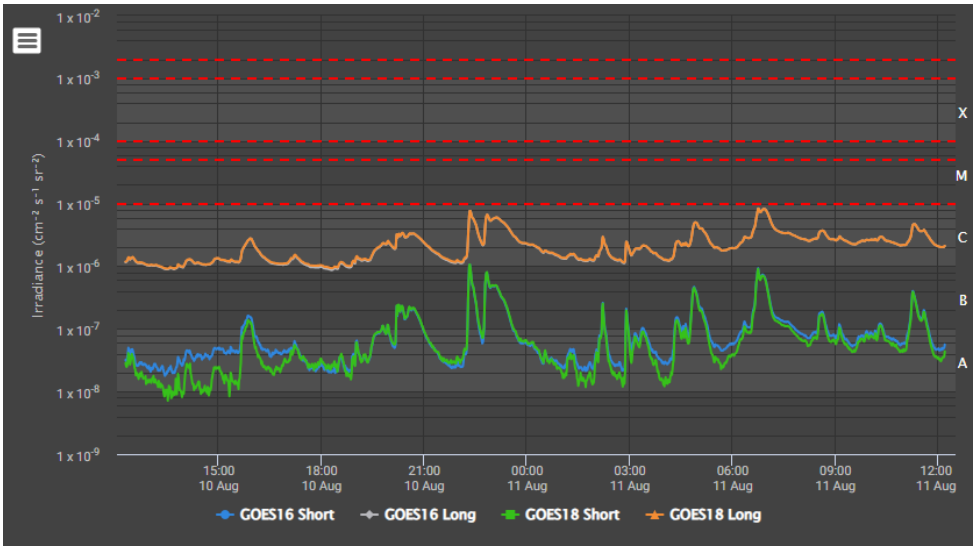

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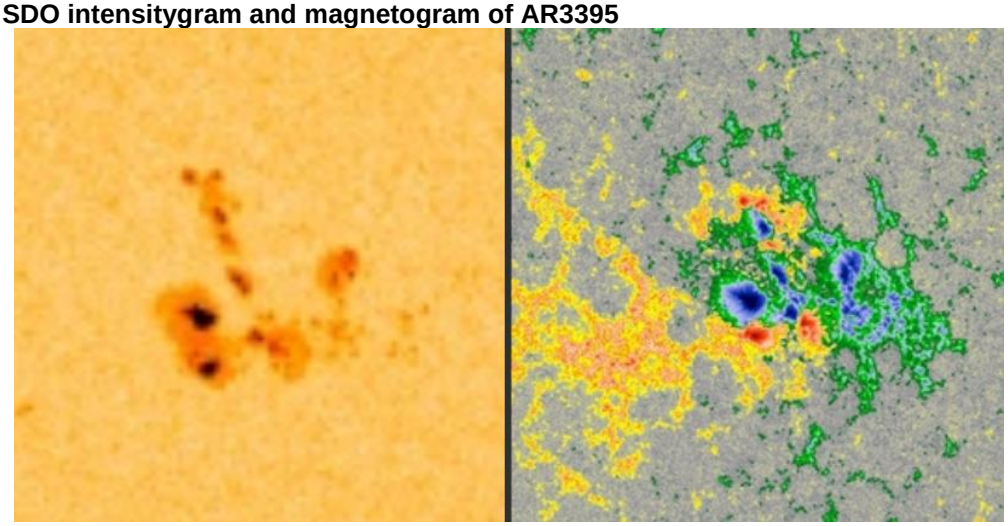
Figure 3b: SDO intensitygram and magnetogram of AR3395

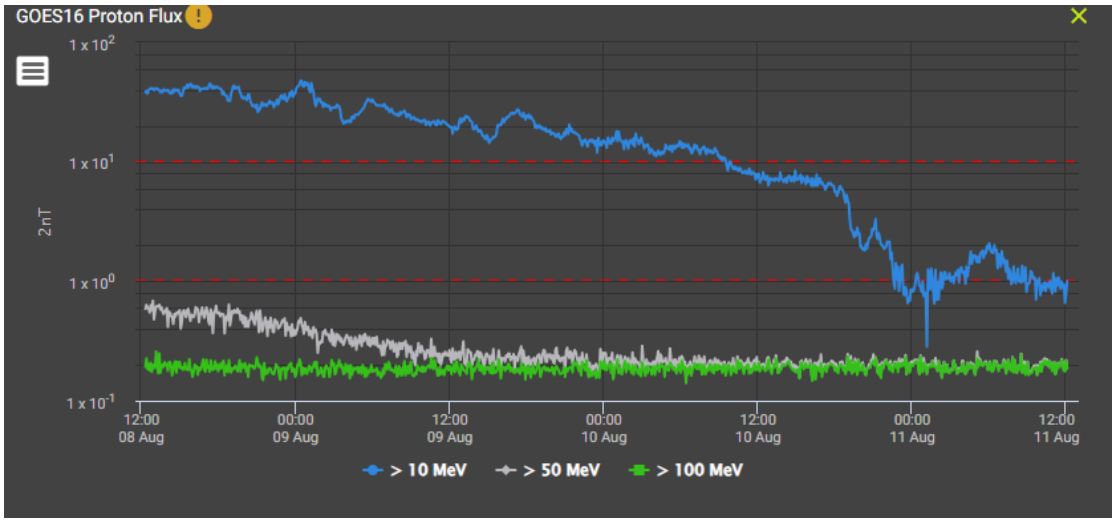


Solar Radiation Storms - (High Energy Protons):

The flux of high energy (greater than 10 MeV) remains slightly above background but easing. The source of the recent enhancement is now well beyond the limb, and unlikely to increase observed flux even given and further strong flare activity. There remains a slight chance of the proton flux increasing however, given the ongoing development of AR3395 in the northwest, and if any development or activation of the large sport AR3394 occurs in the southwest.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	Yes	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: 72 hour GOES-16 >10 MeV >50MeV and >100 MeV Proton flux



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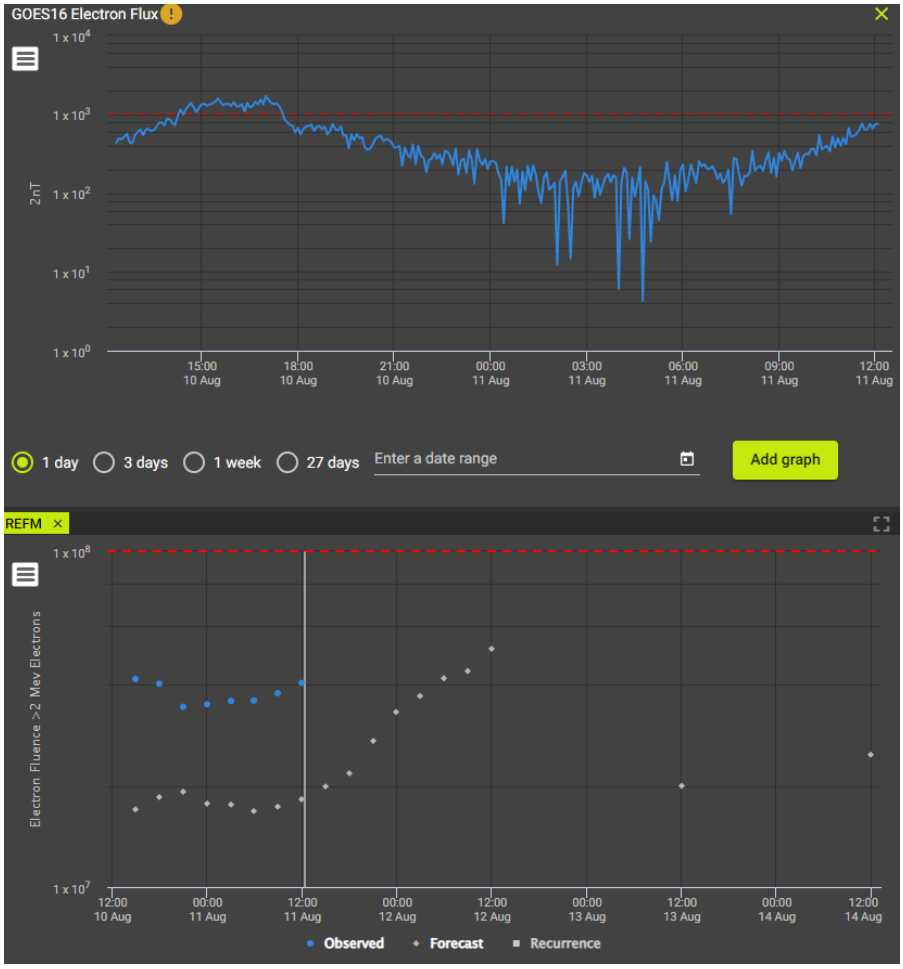
High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux is expected to be mainly at Moderate levels, but showing a diurnal variation from Background to High, likely peaking just over 1000 pfu each day. There are no significant solar wind enhancements expected through the period.

The associated fluence is expected to remain below the Active level, with REFM currently providing good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	5	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: GOES-16 >2MeV Electron flux and associated fluence with REFM



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